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The UK National DNA Database

Balancing crime detection, human rights and privacy

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In 1994, the UK created the legal basis for a national DNA database of people who have been convicted of all but the most trivial offences. Since its creation one year later, the National DNA Database (NDNAD) has grown to include DNA samples from 2.7 million individuals—about 5.2% of the UK population (Home Office, 2006)—many of whom have never been charged with, or convicted of, any offence. It is the oldest, largest and most inclusive national forensic DNA database in the world. Under current law, it might expand to include 25% of the adult male population, along with about 7% of adult women (Williams & Johnson, 2005a).

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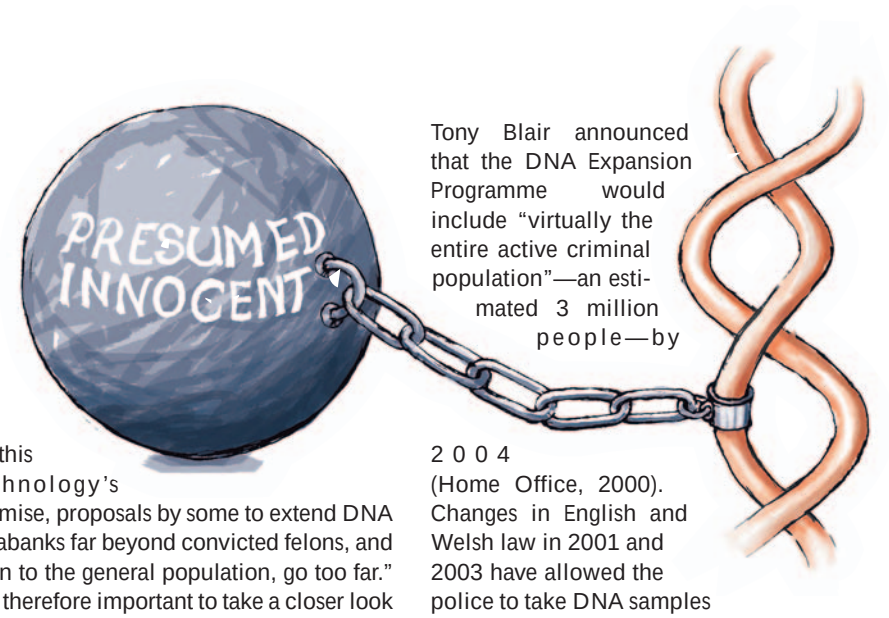
Given its broad coverage, the database has raised concerns about privacy, government surveillance and human rights (McCartney, 2004; Williams & Johnson, 2004). These repercussions stretch beyond the borders of the UK, as many other countries are considering the creation or expansion of similar forensic DNA databases (Williams & Johnson, 2005b). For instance, New York State Governor George Pataki has sought to take DNA samples from people convicted of any misdemeanour—a proposal that has met with widespread criticism—and other states are planning to take DNA samples on arrest. "I still firmly believe in the power of DNA to catch the guilty and exonerate the innocent," wrote Harlan Levy, a former assistant district attorney in New York City (Levy, 2006). "But for all this technology's promise, proposals by some to extend DNA databanks far beyond convicted felons, and even to the general population, go too far." It is therefore important to take a closer look at the NDNAD, the legal and social controversies it has created, and whether its expansion following changes to the law in 2001 and 2003 has led to more convictions or acquittals based on DNA evidence.



In 1994, the British Parliament passed the Criminal Justice and Public Order Act, which provided the legal foundation for the NDNAD. The act allows the police to take DNA samples without consent from anyone charged with any offence that is classified as 'recordable', and also to search the database speculatively for matching profiles. The NDNAD became operational in 1995, but was initially limited—by funding considerations—to include only violent and sexual offences and domestic burglary. However, nearly all offences are recordable, including begging, being drunk and disorderly, and taking part in an illegal demonstration.

From 1996 to 2003, legislation continually expanded the powers of the police to take and retain DNA samples (Williams *et al*, 2004). In 2000, British Prime Minister Tony Blair announced that the DNA Expansion Programme would include "virtually the entire active criminal population"—an estimated 3 million people—by 2004 (Home Office, 2000). Changes in English and Welsh law in 2001 and 2003 have allowed the police to take DNA samples without consent from anyone arrested in connection with any recordable offence, even if they have not been charged. All DNA samples are kept permanently by the companies that analyse them, and the DNA profiles and personal data—such as name and ethnic group—are kept permanently in the national database, even if the person is never charged or is acquitted (GeneWatch UK, 2005).

Three major changes have taken place as part of the 2000 DNA Expansion Programme. The first has been a change in practice, as the police have started to collect much more DNA from scenes of property-related, 'volume' crime, such as burglary and car theft. Second, a change in the law in England and Wales in 2001 has allowed the permanent retention of DNA profiles from people who are charged but subsequently acquitted or not proceeded against. Although this has affected the number of profiles retained, it is unclear to what extent the previous law, which required the records to be removed, had been implemented before this date; an

estimated 50,000 profiles might have been kept illegally in the database before the 2001 law was changed (Her Majesty's Inspectorate of Constabulary, 2000). Third, a 2003 change in the law in England and Wales, which came into effect in April 2004, has allowed DNA to be collected on arrest rather than on charge. This has affected both the number of individual profiles entered and the number permanently retained, because they are kept even if the individual is never charged with any offence. This decision, made via a late amendment to the Criminal Justice Bill in March 2003, happened less than one week before the bill was debated in the House of Commons and during the first week of the war in Iraq, when it was least likely to attract public attention and debate.

Scotland has its own DNA database, but it exports profiles to the NDNAD. Most profiles from Scotland must be removed if a person is acquitted, although some can now be retained for up to five years. The permanent retention of all profiles was recently rejected by the Scottish Parliament. DNA profiles stored in Northern Ireland are also being transferred to the NDNAD, but new profiles will only be routinely exported once its forensic science service has accreditation.

Without doubt, the NDNAD is a useful tool in criminal investigations. However, the permanent storage of DNA profiles and samples raises important concerns about privacy and rights. These include: the potential threat to 'genetic privacy' if information is revealed about health or family relationships; the creation of a permanent 'list of suspects', including anyone arrested in England and Wales since April 2004, which could be misused by the government or made available to a much wider range of organizations in the future; the exacerbation of discrimination in the criminal justice system; and the use of the NDNAD and/or the DNA samples for genetic research without consent.

Some of these concerns have recently been highlighted in parliament and the press. The NDNAD now contains the DNA profiles of 124,347 people who have been arrested but not charged or cautioned (Burnham, 2005a), 24,000 juveniles (people under 18) who have never been charged, convicted or cautioned (Press Association, 2006), and more than one-third of the black male population of the UK (Randerson, 2006). The debate about the DNA Expansion Programme is therefore concerned with how to balance the benefits of the NDNAD in tackling crime against the threats to civil liberties.

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DNA fingerprinting has undoubtedly become a useful tool in criminal investigations. However, it is important to distinguish between the role of DNA samples in a specific criminal investigation and the role of DNA databases in general. Databases are not required to provide evidence of guilt or innocence when there is a known group of suspects for a crime; a DNA sample can be taken from each individual and the DNA profile—a string of numbers based on specific areas of each individual's DNA—can be compared directly with the profile of a DNA sample from the crime scene. Provided the analysis avoids any errors, there is little cause for concern in using DNA samples in this way and there are significant benefits to criminal investigations. In practice, these comparisons are made using the database, by entering both the profile from the crime scene and the suspect's profile. However, looking for a DNA match among a known group of suspects for a specific crime does not require a database and, in particular, does not require DNA profiles to be retained after an investigation has been completed.

However, the retention of DNA profiles and samples taken from crime scenes can be readily justified, because they could be useful—either for convicting a perpetrator or exonerating an innocent person—if an investigation needs to be reopened. Therefore, concerns about the DNA Expansion Programme relate not to samples from crime scenes but rather to widening the group of individuals from whom DNA can be taken and then kept permanently in the database.

The purpose of performing a database search with individuals' DNA profiles is to see whether any of them is a potential suspect for a past crime. This might include a crime they have been arrested on suspicion of committing—if DNA evidence has been collected from that crime scene—although this type of comparison does not require a database. However, the search will also include any unsolved crime for which a DNA profile is stored from any past crime scene. Because DNA is taken from only a small proportion of crime scenes and for only some types of offence, in most cases the DNA taken from an individual on arrest is relevant only to other past crimes, not to the offence for which they have been arrested. The value of the database is in providing 'cold hits'—unexpected matches between a crime-scene DNA profile and an individual's DNA profile—to introduce a new suspect into an investigation. The purpose of entering increasing numbers of DNA profiles, which are unrelated to the reason for arrest, into the NDNAD is to allow an investigation of a past crime to be reopened by identifying a new suspect.

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The purpose of retaining an individual's DNA profile in a database is to treat them as a suspect for any future crime. This is arguably beneficial when an individual has a record as a 'career criminal' and is considered likely to reoffend or, perhaps, to be deterred from reoffending by retaining their profile. However, it is also possible that a previously innocent person might subsequently commit a crime and be identified because their DNA profile is already in the database.

Although DNA can undoubtedly be useful in exonerating the innocent, a database of individual DNA profiles—as opposed to crime-scene profiles—is never necessary to exonerate an innocent person, because this can always be done by comparing the suspect's DNA profile directly with the DNA profile from the crime scene. The added value of putting individuals' profiles in a database is to introduce new suspects into past or future investigations, not to exonerate the innocent. This depends on the number of cold hits and the extent to which these matches lead to successful prosecutions.

In view of this, it is valid to ask whether the recent expansion of the NDNAD and the retention of DNA samples has led to a higher rate of convictions and/or acquittals. In January 2006, the Home Office released a report on the DNA Expansion Programme, which claims that it has been a major success (Home Office, 2006). The report includes some new data on DNA matches, detections and detection rates (see sidebar).

Although the number of DNA detections has increased significantly since the start of the DNA Expansion Programme in 2000, it peaked in 2002/2003 at 21,098 and then dropped to 19,873 in 2004/2005, when the DNA profiles of 124,347 people who had been arrested but not charged or cautioned were first retained in England and Wales. The Home Office argues that this decrease occurred because there were fewer crimes, and therefore fewer crime-scene visits and less DNA from these scenes loaded into the database, thus leading to fewer matches.

> Yet given that the detection rate has not noticeably increased … there seems to be a rapidly diminishing return from adding more individuals to the NDNAD

However, this indicates that it is the number of DNA profiles from crime scenes added to the NDNAD—not the number of individuals' profiles retained—that largely determines the number of detections (GeneWatch UK, 2006). This analysis is further confirmed by comparing the DNA-detection rate with those from previous years; this number has remained relatively constant for the years for which figures are available (38% in 2002/2003, 43% in 2003/2004 and 40% in 2004/2005), whereas the number of individuals' profiles kept in the NDNAD has expanded rapidly during this period (from 2 million in 2002/2003 to 3 million in 2004/2005; NDNAD, 2003; Home Office, 2006). This implies that detections have increased since 1999 because more crime-scene DNA profiles have been loaded, not because there have been more detections per crime-scene DNA profile. If adding or keeping more DNA from individuals rather than from crime scenes were important, the DNA detection rate—the likelihood of making a detection—would have increased as the NDNAD expanded.

In fact, the number of cases that can be solved using DNA analysis will always be limited by the number of crime scenes from which DNA profiles can be collected and the need for corroborating evidence. The number of such profiles loaded into the NDNAD has increased significantly during the DNA Expansion Programme, particularly from scenes of volume crime, such as burglaries. However, in 2003/2004, the number of crimes yielding DNA either levelled off or decreased, depending on the type, indicating that the increase in the number of profiles might be at an end. It is unlikely that it will be possible to obtain DNA profiles from more than 1% of crime scenes for several reasons. For example, many types of crime do not have an obvious scene, DNA is simply not left at many crime scenes and not all DNA samples yield useable profiles (Home Office, 2006). In theory, if everyone's profiles were in the NDNAD, the DNA match rate—the number of DNA matches per crime-scene sample—could increase to 100%. However, the DNA-detection rate or conviction rate would never be this high, because not all matches will lead to detections or convictions. A 50% detection rate could be achievable, compared with 40% today, leading, perhaps, to DNA detections for 0.5% of crimes. Yet given that the detection rate has not noticeably increased and a 50% DNA-detection rate might be difficult to reach, there seems to be a rapidly diminishing return from adding more individuals to the NDNAD.

The NDNAD contains DNA profiles and other information from individuals and crime scenes, linked to the original DNA samples. The DNA profiles are a string of numbers based on specific areas of each individual's DNA, known as short tandem repeats. The DNA samples, however, contain much more genetic information (about health, for example), which raises additional privacy concerns. Although the profiles are owned by the database, the samples remain the property of the police force that collected them, and are stored permanently for an annual fee by the companies that analyse them.

In England and Wales, the Forensic Science Service (FSS; Birmingham, UK), LGC Ltd (Teddington, UK) and Forensic Alliance through Cellmark—a subsidiary of Orchid BioSciences (Princeton, NJ, USA) that has recently become part of the LGC Group—are all accredited to analyse DNA samples and supply profiles to the NDNAD. In Scotland, only the Police Forensic Science Laboratories are currently allowed to supply DNA profiles to the database. Although Scotland exports profiles to the NDNAD in England, it does not export samples.

> There is nothing to prevent future research without consent using either the NDNAD or samples for purposes such as searching for 'genes for criminality'

Retaining DNA samples from individuals is not necessary in order to avoid miscarriages of justice, because a second DNA sample is always taken from someone being prosecuted, to confirm the match with the DNA profile from the crime scene. This second match, rather than that in the NDNAD, is used in court proceedings. The stored DNA samples are also not used in criminal investigations, because it is the DNA profile from the NDNAD that is used for comparison with the DNA profile from the crime scene.

The NDNAD Board argues that samples must be kept for quality control and to check for errors. However, samples need not be kept permanently; they could be stored for only a limited time until an investigation is complete. The board also argues that keeping samples allows the NDNAD to be upgraded to use more detailed profiles in the future. Although this was necessary when the NDNAD was first set up, it is likely to be costly and impracticable given its current size, and would make the NDNAD incompatible with other databases internationally. It is also always possible to obtain a more detailed profile from the second DNA sample that is taken from the defendant for use in court. The UK government's advisory body, the Human Genetics Commission, concluded that the reasons given for retaining individuals' samples are not compelling (Human Genetics Commission, 2002), and has argued that samples from those who are arrested but not charged or convicted should be destroyed when a successful profile has been obtained (Human Genetics Commission, 2005).

The UK Home Office has recognized that retaining DNA samples is "one of the most sensitive issues to the wider public" (Home Office, 2005a). However, its report on the DNA Expansion Programme provides neither new information to justify the permanent retention of DNA samples,

nor any information about storage costs (Home Office, 2006). In 2005, the House of Commons Science and Technology Committee recommended that "Independent research should be undertaken to assess the public attitude towards retention of DNA samples (both from convicted criminals and others), and the evidence of benefits associated with this practice" (House of Commons Science and Technology Committee, 2005a). But this recommendation was merely noted by the government (House of Commons Science and Technology Committee, 2005b) and has been ignored subsequently.

> …the creation of an independent, transparent and accountable governing body would do much to restore or increase public trust in police use of DNA profiles and samples

Although the NDNAD can increase the number of detections—and potentially convictions—it has long been recognized that the costs must be weighed against other policing methods in order to ensure best value. In 2000, Her Majesty's Inspectorate of Constabulary reported huge uncertainty about the estimated costs per match (ranging from UK£443 to UK£13,114) and per detection (ranging from UK£788 to UK£2,342) depending on how they were calculated (Her Majesty's Inspectorate of Constabulary, 2000). Although the 2006 Home Office report provides some new figures on the unit costs of processing each sample, these shed little light on costs or cost-effectiveness, because the analysis includes neither police time nor the costs of storing samples permanently.

Until recently, the NDNAD was managed by the FSS for the Association of Chief Police Officers of England, Wales and Northern Ireland. The FSS has recently changed its status from a trading fund to a government-owned company, with a view to possible partial privatization. Loading DNA profiles into the NDNAD and reporting subsequent matches is still carried out under contract by the FSS; however, the setting of standards and the supervision of the NDNAD are being transferred to a dedicated unit in the Home Office, governed by the NDNAD Board. The board includes representatives of the Home Office, the Association of Chief Police Officers, the Association of Police Authorities and the Human Genetics Commission (Home Office, 2005b). There are also plans, although not yet implemented, to create a separate group to give advice on ethical questions (Burnham, 2005b).

The practice of using the NDNAD for genetic research without consent or ethical regulation is controversial, as is the decision to use 'familial searching' to identify suspects through their relatives in the database (House of Commons Science and Technology Committee, 2005a). Use of the NDNAD is restricted to detecting or reducing crime. However, this has been interpreted broadly by the board to include research on predicting characteristics, such as ethnicity, from DNA samples (Lowe *et al*, 2001). There is nothing to prevent future research without consent using either the NDNAD or samples for purposes such as searching for 'genes for criminality'.

Concerns come not only from critics but also from within the police and forensic services. During a recent public consultation in Scotland, the police liaison officer for the Scottish Police DNA Database expressed concerns that blanket retention of DNA profiles and samples could reduce public support for police use of DNA. Thomas Ross stated that "It is arguable that the general retention of profiles from the un-convicted has not been shown to significantly enhance criminal intelligence or detection" (Ross, 2005). There is, indeed, little evidence that retaining DNA profiles and samples from innocent individuals has made any significant difference to the detection of crimes in England and Wales. Press reports are also beginning to reflect public concerns about the number of innocent people, particularly children, whose data are kept in the NDNAD and about its bias towards black males. It seems likely that the government has overstepped a line by expanding the numbers of individuals retained permanently in the NDNAD, thereby losing public trust while gaining little benefit to criminal intelligence.

DNA MATCHES, DETECTIONS AND DETECTION RATES

A DNA 'match' indicates that the DNA profile of an individual in the NDNAD matches a DNA profile taken from a crime scene. Provided that the samples have not been contaminated or mixed up, the DNA is not degraded, and a full profile can be obtained, a match indicates a high probability—although not certainty—that the DNA at the crime scene came from that individual.

'Detections' are crimes that have been recorded as 'cleared up' by the police. This includes crimes for which a person has been charged, cautioned or warned, and some that are not proceeded against—for example, because the victim is unwilling to give evidence. For charges to be brought to court, additional evidence is always needed, for example from witnesses, to show that the individual might have committed a crime. Therefore, only about half of the DNA matches lead to DNA detections. In 2004/2005, 49% of matches led to a detection (Home Office, 2006)—although this figure rose to 58% in a smaller but more detailed evaluation study that was cited by the Home Office but not published. This conversion rate of matches to detections is largely determined by volume crimes, such as burglary, and might not apply to different types of offence.

The figures for DNA detections do not show whether the individual was first identified as a suspect for the crime through use of the NDNAD or was already a suspect when their profile was entered. This is an important distinction because the added value of entering DNA profiles from individuals into a database—as opposed to the use of DNA in crime investigations—is only its contribution to new detections or 'cold hits' leading to a detected crime, not to detections between an existing suspect and a crime scene. However, a research exercise carried out in 2002/2003 that followed 620 cases involving DNA matches found that "in 58% of all detected cases, the DNA match was the first link to the offender" (Home Office, 2006).

The overall detection rate is the number of detected crimes divided by the number of recorded crimes: this is the proportion of crimes that are detected in a given year (26% in 2004/2005; Home Office, 2006). The DNA detection rate is the number of DNA detections divided by the number of cases for which a DNA profile from a crime scene was entered into the NDNAD; this measures the proportion of crime-scene DNA profiles that led to a detection (40% in 2004/2005; Home Office, 2006). The proportion of total crimes detected using DNA is, however, much lower, because crime-scene DNA profiles are entered into the NDNAD for less than 1% of all recorded crime. For example, in 2004/2005, only 0.35% of crimes were detected using DNA. Despite the rapid expansion of the NDNAD, this is the same percentage of crimes that were detected using DNA in 2002/2003 and 2003/2004 (GeneWatch UK, 2006; calculated from figures in Home Office, 2006).

Some important changes could be made to safeguard privacy and individuals' rights without compromising the use of DNA in tackling crime. First, a public debate could address who should be in the NDNAD and for how long. The aim would be to develop a policy of time limits on the retention of profiles in the NDNAD in relation to the seriousness of an individual's offence and whether they have been convicted. Such a policy on retention would limit the potential for future governments to misuse the data to restrict people's rights and freedoms. Second, individuals' DNA samples should be destroyed once an investigation is complete and after the DNA profiles used for identification have been obtained. This would limit the potential for revealing and analysing personal genetic information in the future. Third, the practice of allowing companies to undertake controversial genetic research using the NDNAD should be stopped, as it violates ethical requirements for informed consent to genetic research. Fourth, the government should return to its previous policy of taking DNA at the time of charging an individual, except when a sample is needed to investigate the specific crime for which a person has been arrested. This would reinstate an important safeguard against the discriminatory collection of DNA profiles. Fifth and last, the creation of an independent, transparent and accountable governing body would do much to restore or increase public trust in police use of DNA profiles and samples.

As Levy commented on similar plans in the USA: "DNA databases should expand, but some fundamental principles should guide their development: government should aim DNA collection at those most likely to commit the crimes DNA can solve (rape and murder); before expanding collection, it should focus on improving laboratories and testing samples from unsolved violent crimes sitting untested in storage closets or refrigerators; and it should recognize (as have some but not all of our courts) that it does not have an unlimited right to every person's DNA without some showing of special need" (Levy, 2006).

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